Management Plan
BV-2C Dredged Material Management Area

August, 1992

Management Plan
BV-2C Dredged Material Management Area

Prepared For:

FLORIDA INLAND NAVIGATION DISTRICT

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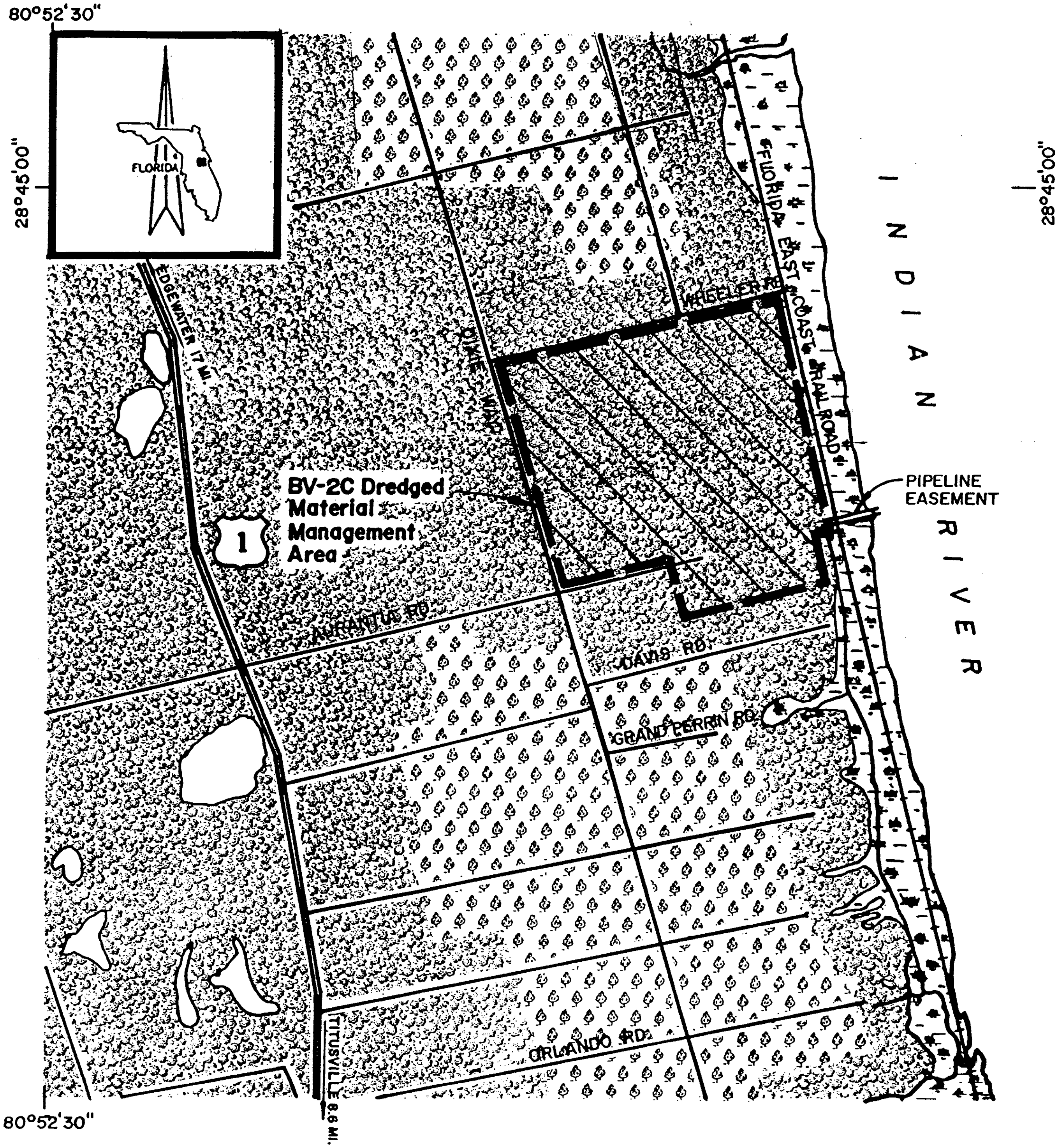
1.0 INTRODUCTION

A key element in the long-term utilization of any dredged material management facility is the development and implementation of a site-specific management plan. Such a plan for Dredged Material Management Area BV-2C is outlined in this report. It is intended to provide guidance for the development and operation of the facility so that optimum efficiency is achieved in both effluent quality and containment area service life while minimizing the impact of the site on the environment and adjacent areas. This plan document addresses are those facets of site design and operation which directly influence site efficiency or reduce off-site conflicts. These include elements of site preparation prior to the initial dredging and deposition of maintenance material, techniques of decanting and dewatering the maintenance material during and immediately following a maintenance event, and criteria for post-dredging site operation and maintenance. The goal of each phase of site management is to ensure that the site not only achieves its minimum design 50-year service life, but that it also fulfills its potential as a permanent operating facility for the intermediate storage and re-handling of maintenance material dredged from the Intracoastal Waterway (ICWW).

Site BV-2C (Figure 1-1) is one of eight maintenance material management sites selected to provide long-term dredged material containment capacity for the Intracoastal Waterway (ICWW) in Brevard County, Florida. It is intended to serve Reach I of the ICWW as designated by Taylor and McFetridge (1991). This reach extends 7.74 miles from a point 2.6 miles south of the Brevard-Volusia county line (ICWW mile 126.33) to the vicinity of Mims (ICWW mile 134.07). A comprehensive evaluation of dredging records for this portion of the Waterway indicates that maintenance dredging has been carried out four times since the establishment of the 12 foot project depth in 1953 (Taylor et al., 1989). Moreover, a 1987 reconnaissance survey revealed the presence of additional shoaling in several locations. Based on these findings, the projected 50 year containment requirement for Reach I is estimated to be 3,162,180 cubic yards (cy). This represents the projected 50-year in-situ volume of shoaling multiplied by a bulking plus over-dredging factor of 2.15. It is expected that dredging within this reach will be performed at an average frequency of once every five to ten years, based on operational considerations of scheduling and contract procedures, as well as patterns of shoaling. Each maintenance event will produce between 316,218 and 632,436 cy of material.

The total site area of BV-2C is 311.39 acres, of which approximately 151.71 acres will lie outside of the containment dike. Existing vegetation in this perimeter area will remain largely undisturbed, providing a natural buffer around the containment area. It is anticipated that portions of the buffer area will be leased by the former property owners for continued use in active citrus production,



REFERENCED

USGS MIMS, FLORIDA QUADRANGLE 1949, REVISED 1970.
USGS OAK HILL, FLORIDA QUADRANGLE 1949, REVISED 1970.

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TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 1 - 1 Location of Site BV-2C Dredged Material Management Area Brevard County, Florida	PROJECT C-9004 REVISION SHEET DATE Aug., 1992

however a formal lease agreement has not been executed at the time of this writing. The projected initial site containment capacity of 3,241,188 cy is adequate to meet the 50-year reach containment requirement (Taylor and McFetridge, 1991).

As stated above, beyond satisfying an initial capacity requirement, the management objectives for BV-2C are to efficiently process (i.e. decant and dewater) the dredged material, and to operate the facility so as to extend its usefulness beyond the design service life. The potential long-term efficiency of the containment area is established by the design and construction of the facility, while the degree to which this potential is realized is largely determined by operating procedures. Specific elements of site design and operation during and following dredging activities will be discussed, in turn, as they relate to site efficiency and local impacts. However, design features and construction practices, beginning with site preparation, provide the foundation for the project, both physically and figuratively, and should therefore reflect the level of effort that has gone into the selection of Site BV-2C, as well as the substantial long-term commitment of state and federal funds that this project represents. The plan document begins in Section 2.0 with a discussion of site preparation and design. Site operational considerations during dredging are discussed in Section 3.0. Post-dredging site management is addressed in Section 4.0.

2.0 PRE-DREDGING SITE PREPARATION AND DESIGN FEATURES

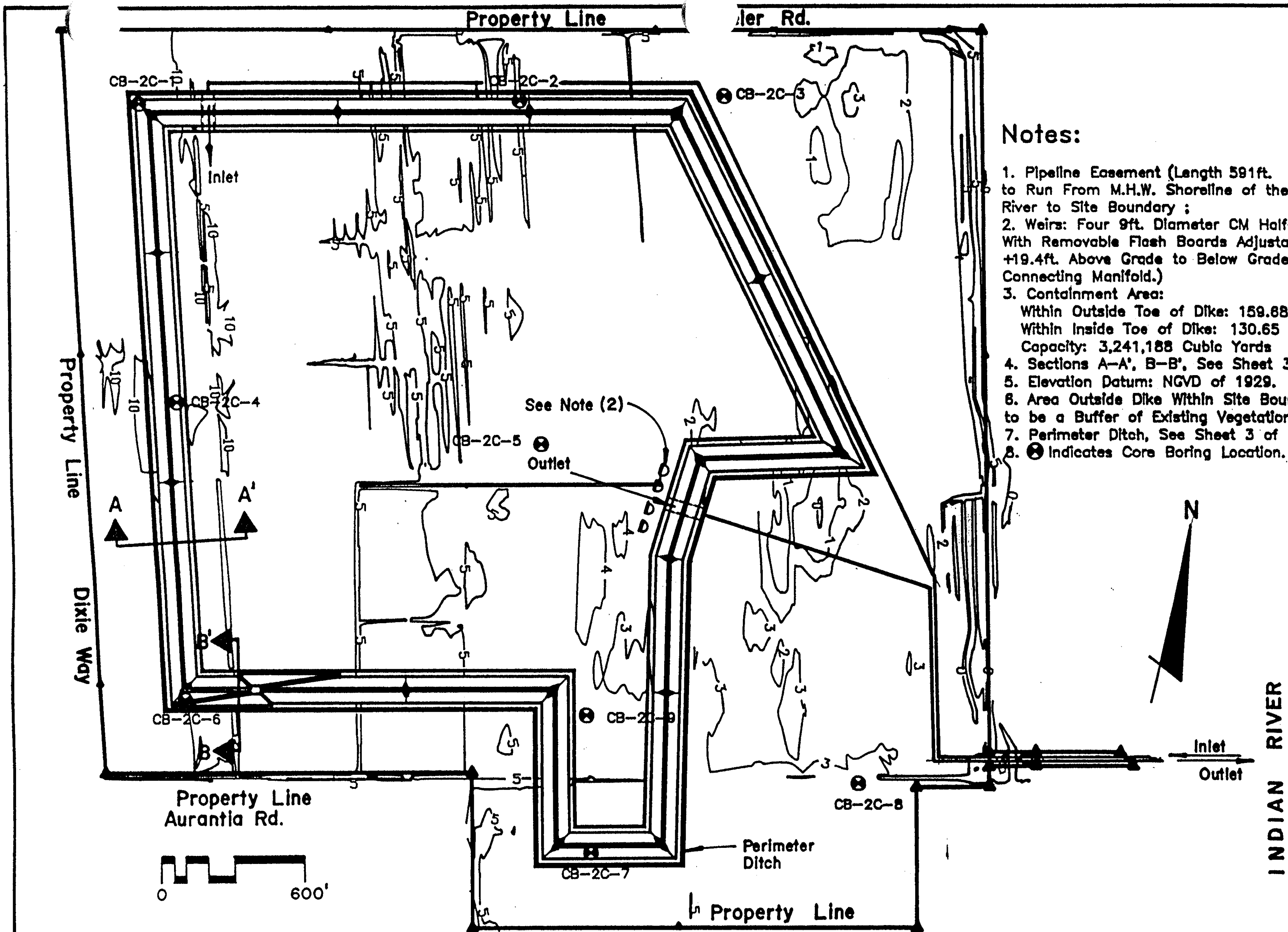
2.1 Site Design

No attempt will be made here to address, in detail, all elements of site design. These are described elsewhere in the permit documentation. Rather, the present discussion will be limited to those aspects of site design which directly influence site operation and maintenance.

2.1.1 Containment Basin Configuration

One of the fundamental design elements of the BV-2C dredged material management facility is the location and configuration of the containment basin within the site. As discussed above, the first requirement to be met by the containment basin is a minimum capacity 3,162,218 cy. The configuration presented in Figures 2-1 and 2-2, and discussed in the following paragraphs provides a storage capacity of 3,241,188 cy.

The basin configuration shown in Figures 2-1 and 2-2 also minimizes the impacts of site development on environmentally sensitive areas and adjacent properties. As stated above, the total area of the BV-2C material management facility is 311.39 acres, of which approximately 151.71 acres will be preserved as a buffer area surrounding the containment basin. Providing the required disposal capacity requires a basin area of 159.68 acres. An additional 9.51 acres will be impacted by the excavation of a perimeter ditch and the construction of access roads surrounding the containment area. Thus, a total of 169.19 acres will be impacted by the development of the containment facility. This represents approximately 54 percent of the total area of the site, leaving 46 percent of the total acreage as a natural buffer area. As shown in Figure 2-1, the configuration of the facility provides a 300 foot wide buffer on the north, west, and south sides of the containment dikes, containing a band of undisturbed vegetation approximately 265 feet in width. The eastern buffer, varying in width from 500 to 1,400 feet, was configured to include all on-site Florida Department of Environmental Regulation (DER) jurisdictional wetlands. The management of these wetlands is discussed in more detail in Section 4.5. An additional benefit of the buffer is the isolation of the containment basin from existing and future development on adjacent properties.



Notes:

1. Pipeline Easement (Length 591ft. ,Width 60ft.) to Run From M.H.W. Shoreline of the Indian River to Site Boundary ;
2. Weirs: Four 9ft. Diameter CM Half-Pipes With Removable Flash Boards Adjustable From +19.4ft. Above Grade to Below Grade(With Connecting Manifold.)
3. Containment Area:
   Within Outside Toe of Dike: 159.88 Acres
   Within Inside Toe of Dike: 130.65 Acres
   Capacity: 3,241,188 Cubic Yards
4. Sections A-A', B-B', See Sheet 3 of 4.
5. Elevation Datum: NGVD of 1929.
6. Area Outside Dike Within Site Boundary to be a Buffer of Existing Vegetation.
7. Perimeter Ditch, See Sheet 3 of 4.
8. ⊗ Indicates Core Boring Location.

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Figure 2-1
Site Plan
BV-2C Dredged Material Management Area,
Brevard County, Florida

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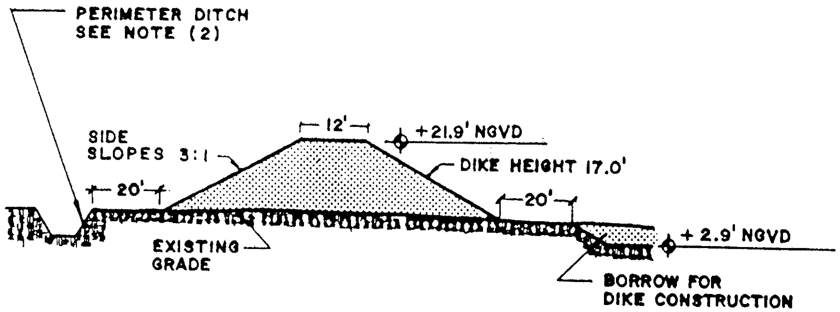
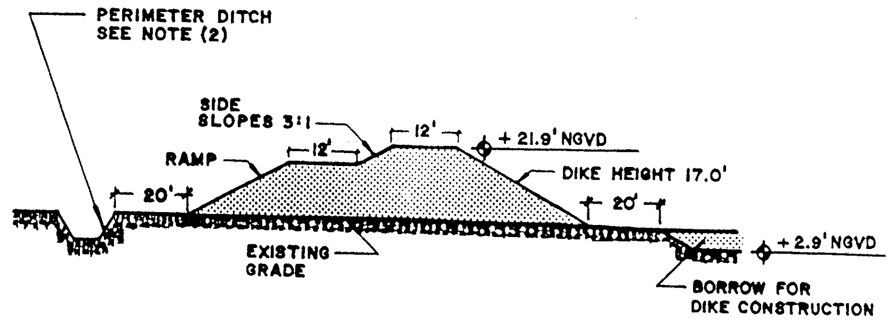
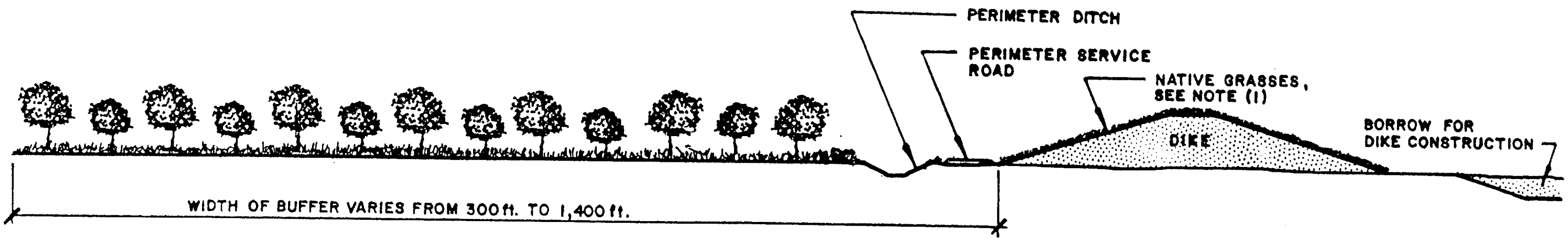


SECTION A-A'
N.T.S.



SECTION B-B'
N.T.S.



DISPOSAL AREA - VEGETATION PLAN
N.T.S

NOTES:
1. TYPICAL SPECIES INCLUDE:
   PASPALUM VAGINATUM
   SPARTINA PATENS
   SPOROBOLUS SPECIES
2. PERIMETER DITCH:
   SIDE SLOPE: 3:1
   BOTTOM WIDTH: 3 ft.
   MEAN INVERT ELEV.: 2 ft.
   BOTTOM SLOPE AS REQUIRED
   FOR DRAINAGE

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Figure 2-2
Typical Dike and Ramp Sections, Vegetation Plan
Site BV-2C
evard County, Florida

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2.1.2 Site Capacity

As stated earlier, the projected capacity of Site BV-2C is approximately 3,241,188 cy. The design capacity of the containment basin will be reached when the surface of the deposition layer is 4.0 feet below the dike crest, thereby providing an additional 2.0 feet of freeboard and 2.0 feet of ponding. To obtain this capacity within the 159.68 acre dike footprint, it will be necessary to construct the dikes to a crest elevation of 17.0 feet (+21.90 ft NGVD) above the existing mean site grade of +4.90 ft NGVD (Figures 2-1, 2-2). Based on a conservative dike cross-sectional design including side slopes of 1V:3H and a crest width of 12 feet, 440,196 cy of material will be required. An additional 3,618 cy will be required to construct ramps for equipment access to the interior of the containment basin. The material for dike and ramp construction will be obtained from two sources. The majority the material will be obtained from the excavation of the interior of the containment basin. Material will also be obtained from grading and excavation related to the construction of a system of perimeter ditches surrounding the containment dikes. A more detailed discussion of site grading operations is provided in Section 2.2.2.

2.2 Site Preparation

Site preparation required for the BV-2C material management area will consist of two phases. The first phase will include the clearing and grubbing of vegetation in the area of the containment basin and the fence line, and the installation of the security fence. An on-site access road will also be constructed at this time. This phase will be completed as soon as practical following site acquisition. The second phase of site preparation will consist of the construction of the containment basin and perimeter ditches, and the installation of the outlet structures and other design features. This phase of site preparation will proceed on a schedule to be determined by the needs of the Jacksonville District Corps of Engineers, and therefore may not immediately follow the completion of the first phase. However, the site will be secured by a fence, and security procedures will be in place prior to the commencement of excavation, grading, and dike construction. In the remainder of this section each element of site preparation is discussed in more detail.

2.2.1 Clearing and Grubbing

The first phase of site preparation begins with the required clearing and grubbing of vegetation to facilitate containment basin construction and the installation of security fencing. Historically, containment area construction has often been accomplished without any interior site preparation. Moreover, it is recognized that clearing and grubbing vegetation and uniformly excavating and grading the site interior adds significantly to the initial construction cost of the containment area, and should not be undertaken without the expectation of significant benefits. However, it is felt such measures are warranted in the present situation. It has been established (Haliburton, 1978; Gallagher, 1978) that a limited growth of herbaceous vegetation or native grasses can improve sedimentation by filtration. However, woody vegetation (i.e. trees and brush present in the proposed BV-2C material management area) can constrict or channelize the flow through the containment basin, resulting in short-circuiting, reduced retention times, resuspension of sediment through increased flow velocities, and the deterioration of effluent quality. Additionally, a failure to clear existing vegetation will make the periodic removal of the dewatered dredged material much more difficult. Therefore, the containment area should be cleared and grubbed prior to construction.

2.2.2 Excavation and Grading

The second phase of site preparation includes all earthmoving operations required to construct the containment dike and basin to the design geometry. Examination of soil survey records of Brevard County (Huckle et al., 1974) indicates that the soils on site are adequate for use as dike material. However, a detailed subsurface survey will be conducted prior to the commencement of construction operations to verify the suitability of the soil and to determine the on-site water table elevation. As discussed in Section 2.1.2, the dike material will be obtained from two sources. First, the basin interior will be excavated to a mean elevation of +2.90 ft NGVD, or 2.0 feet below the existing site grade of +4.90 ft NGVD, providing 428,094 cy of material. The excavation will be set back 20 feet from the inside toe of the dike, and will maintain the same 1V:3H side slope as the dike. Second, a system of perimeter ditches to promote adequate site drainage and to prevent the horizontal migration of saline water from the interior of the containment basin will surround the containment basin at a 20 foot setback from the exterior dike toe. The ditches will be excavated to a mean depth of +2.90 ft NGVD, or 2.0 feet below the surrounding grade. The bottom slope of the ditches will approximate that of the basin interior. The volume of material obtained from the perimeter ditch excavation is 15,720 cy. Thus, the total volume of material produced from the operations described above equals 443,814 cy, which satisfies the requirements for dike and ramp construction.

It is also necessary that the interior of the containment be graded following the completion of excavation. Construction efficiency may dictate that dike material be initially taken from a perimeter trench inside the containment dike. However, it is imperative that this trench be eliminated and that the site interior be re-graded prior to the initiation of disposal operations if acceptable effluent quality is to be achieved. The irregular topography within the containment area, resulting from the excavation operation, will cause the flow from inlet to weir to channelize. This would lead to a reduced effective sedimentation area, increased flow velocities, and decreased solids removal efficiency. Moreover, irregular topography will produce non-uniform deposition which, in turn, will result in the ponding of surface water, thereby inhibiting the drying of the deposition layer and making initial attempts at surface trenching more difficult. For these reasons, it is important that a uniform grade be provided from inlet to weir with an adequate slope on the order of 0.1 percent as part of the initial construction of the facility. It is also recognized that given an initially level surface, differential settling of varying grain size fractions (i.e., rapid precipitation of the coarser fractions nearer the inlet with increasingly finer sediments deposited nearer the outlet) will quickly establish a deposition surface sloping downward from inlet to weir once disposal operations begin.

2.3 Additional Design Features

2.3.1 Inlet

The location of the dredge discharge outfall, or pipeline inlet, within the containment basin is the primary means of regulating the pattern of material deposition. The disadvantage of a single, fixed inlet is the characteristic mounding of coarse material in the vicinity of the inlet, which if not mechanically re-distributed, results in reduced retention area. However, the anticipated infrequent requirement for maintenance dredging in this reach of the waterway cannot justify the cost of a fixed, multiple inlet manifold system for the BV-2C containment basin. More appropriate is the use of a moveable single inlet with the flexibility to be repositioned during dredging operations. The single inlet should also be fitted with a device which breaks the momentum of the jet, such as a flow-splitter or a spoon, to aid in the distribution of the slurry.

Preliminary analysis of the dredged material settling behavior within the BV-2C material management area, discussed in Section 2.3.3, indicates that the maximum available distance between inlet and weir may be required to meet effluent turbidity standards. Therefore, relocating the inlet must not result in a significant reduction in the separation distance between inlet and outlet without the implementation of additional precautions to ensure that water quality standards are met. These may include increasing the ponding depth, or the use of floating baffles or turbidity screens surrounding the weirs.

2.3.2 Weirs

The outlet control structures within the containment basin consist of a system of weirs whose primary function is to control the release of the ponded water by maintaining the required ponding depth, thereby providing the required retention time within the containment basin, as discussed above. However, several additional aspects of weir design control the flow of water inside the basin, and thereby strongly influence the efficiency of solids retention and the quality of effluent released from the site. These include the type of weir employed, the length of the weir crest, and the location of the weirs within the containment area. Each of these design aspects and its effect on basin operational efficiency is discussed in the following paragraphs.

The type of weir structure to be employed at the BV-2C material management area represents a compromise between considerations of performance, adjustability, maintenance, and economy. A sharp-crested, rectangular weir is specified to minimize the depth of withdrawal of the clarified water, or supernatant. The term sharp-crested describes a weir in which the thickness of the weir crest (T) is less than the depth of flow over the weir (h); typically $h/T > 1.5$. A rectangular weir is straight, and passes flow over its crest normal to the weir crest axis. The depth of withdrawal is the depth at which the gravity forces on a suspended sediment particle exceed the inertial forces associated with flow over the weir. It therefore represents the depth of the surface layer of ponded water which is drawn over the weir and released from the containment basin. Reducing the depth of the withdrawal layer to less than the ponding depth reduces the possibility of resuspending sediment which has settled out of the water column. Moreover, since the concentration of suspended sediment increases with depth, minimizing the depth of the withdrawal layer maximizes the retention of suspended solids. Specific performance characteristics of the weir system to be employed at the BV-2C material management area are discussed later in this section.

The height of the weir crest is adjustable by means of removable flashboards. The range of adjustment is from the excavated grade at the weirs, +1.45 ft NGVD, to a maximum elevation of +19.4 ft NGVD, or 16.5 feet above the mean excavated grade. The minimum weir crest elevation allows for the removal of stormwater prior to the initial use of the site, while the maximum elevation provides 2.0 feet of freeboard above the maximum deposition surface. The weir flashboards will be 4 x 4 stock, interlocking by tongue-and-groove to provide rigidity against hydrostatic pressure, and to minimize between-board seepage. The milling of the interlocking tongue-and-groove will reduce the height of the flashboards to 3 inches. This provides a minimum adjustment increment which is less than the projected depth of flow over the weir crest (4.9 inches) at the point the weir discharge approximately equals the liquid inflow to the containment area. This design provides the site operator with adequate adjustment resolution to maximize weir performance and effluent quality throughout the dredging operation and the subsequent release of the ponded water.

The minimum length of the weir crest for the BV-2C material management area is 36 feet. This specification is based on results obtained from the U.S. Army Corps of Engineers' Waterways Experiment Station's (WES) Selective Withdrawal Model and represents the weir crest length required to maintain a depth of withdrawal less than the minimum ponding depth of 2.0 feet. For this and all project calculations it has been assumed that a 24 inch O.D. dredge (discharge velocity, 16 ft/sec; volumetric discharge, 6,430 cy/hr; 20/80 solids/liquid slurry mix) will be used for future dredging operations. However, the physical constraints of the channel will most likely dictate the use of a 16 to 18 inch O.D. dredge. Therefore, the assumption of a 24 inch dredge ensures a conservative disposal site design. The 36 foot minimum weir crest length will be provided by 4 corrugated metal half-pipes, each with a sharp-crested weir section length of 9 feet. The four pipes will be connected by a common manifold such that the effluent will exit the containment area via a single pipe under the dike. Analysis of weir performance based on nomograms developed at the Waterways Experiment Station under the Dredged Material Research Program (Walski and Schroeder, 1978) indicates that these design parameters may be expected to produce an effluent suspended sediment concentration of 0.63 g/l. Translation of suspended solids concentration to a measure of turbidity on which Florida water quality standards are based is highly dependent on the suspended material characteristics. However, WES guidelines (Palermo, 1978) indicate that this effluent quality should be adequate.

The final weir design parameter considered is the location of the weirs within the containment basin such that the separation distance of the weirs from the dredge pipe inlet is maximized, and the return distance to the receiving waters is minimized (Figure 2-1). The latter requirement promotes the most efficient transport of the effluent from the containment area using gravity flow. Positioning the weirs as shown in Figure 2-1 provides approximately 2,900 feet of separation between the inlet and the weirs.

2.3.3 Ponding Depth, Sediment Characteristics, and Basin Performance

Ponding depth refers to the height of the water column (with its suspended sediment load) maintained above the depositional surface during dredging and disposal operations. It is regulated by the height of the weir crest, and to a lesser extent, by the dredge plant output. More of an operational criterion than a design feature, ponding depth is nevertheless a primary design consideration, impacting containment area and dike geometry, as well as weir design.

It is advantageous to maintain as great a ponding depth during disposal operations as possible. Increased ponding depths produce increased retention times and decreased flow velocities through the containment basin, and are therefore directly related to improved solids retention and effluent quality. The limiting consideration for increased ponding depth is the unbalanced head, or hydrostatic pressure, which the dikes can withstand without compromising their structural integrity.

An analysis of containment area efficiency was performed to determine the required minimum ponding depth and basin retention time needed for adequate solids retention performance and acceptable effluent quality. The required retention time is, in turn, dependent on the physical characteristics of the sediment to be dredged. Since the fine-grained component of the sediment requires the longest period of time to settle out of the water column in the containment basin, the fine fraction of the material to be dredged determines the required basin retention time and, in turn, the required ponding depth.

The characteristics of the sediment to be dredged within Reach I were derived from the findings of a county-wide study of Indian River sediments conducted by Trefry et al. (1990). This study identified segments of the ICWW channel within Reach I which have sediment deposits containing significant components of fine grained materials overlaying the native bottom material of coarser sand and shell. These deposits range in thickness from less than 1 cm to more than 70 cm. In a previous study (Trefry and Stauble, 1987), the deposited sediments were determined to contain on average 66.5 percent "fines," that is, sediments less than 0.074mm grain size diameter. These fines are primarily composed of aluminosilicates derived from the erosion of upland soils with an additional small fraction of organic material. In contrast, the coarser native bottom material was determined to contain only 11.5 percent fines, again consisting primarily of aluminosilicates with an additional small fraction of organics.

These data were then analyzed with respect to the most recent ICWW channel survey data (1987). From this analysis it was determined that 23.3 percent of the in-place volume of shoal sediments within Reach I is made up of fine material as previously defined. Organics, which represent a small component of the fines, make up only 3.4 percent of the total shoal volume.

However, the Trefry report also indicates that some areas of the ICWW channel within Reach I contain deposits of fine-grained sediments in excess of 30 cm thick. Dredging these areas could result in short periods during which the sediments entering the containment basin contain up to 60 percent fines. Therefore, to ensure that the containment basin is able to meet or exceed all effluent discharge and water quality criteria, its design is based on the "worst-case" assumption that the dredged material contains 60 percent fines. This does not imply that all of even a majority of the material to be stored in the BV-2C containment basin contains such a high fraction of fines. As discussed in the preceding paragraph, available data indicate that fines represent less than one-quarter of the Reach I shoal material.

Based on the above design criterion, an associated zone settling velocity was then determined from an empirical relationship between the percentage of fines and settling behavior. This relationship was developed from COE sediment data characterizing a variety of ICWW channel sediments and the corresponding settling behavior of slurry concentrations similar to those typically encountered in dredging operations (Figure 2-3; Taylor and McFetridge, 1989). The resulting zone settling velocity for the sediment to be placed in the BV-2C containment basin was determined to be 0.30 cm/min. This settling velocity was then used to determine the retention time needed to provide adequate sedimentation within the containment basin.

The preliminary design of the containment area and dikes provides for a minimum 2.0 foot ponding depth. That is, at capacity the containment dike will retain 2.0 feet of ponding plus 2.0 feet of freeboard above the maximum deposition surface. Analysis of the hydraulic characteristics of the proposed containment area indicates that a 2.0 feet ponding depth will provide a maximum retention time of 82.4 hours during the period in which the flow over the weir balances the liquid discharge of the dredge. In comparison, the time required for the suspended sediment to settle out of the withdrawal

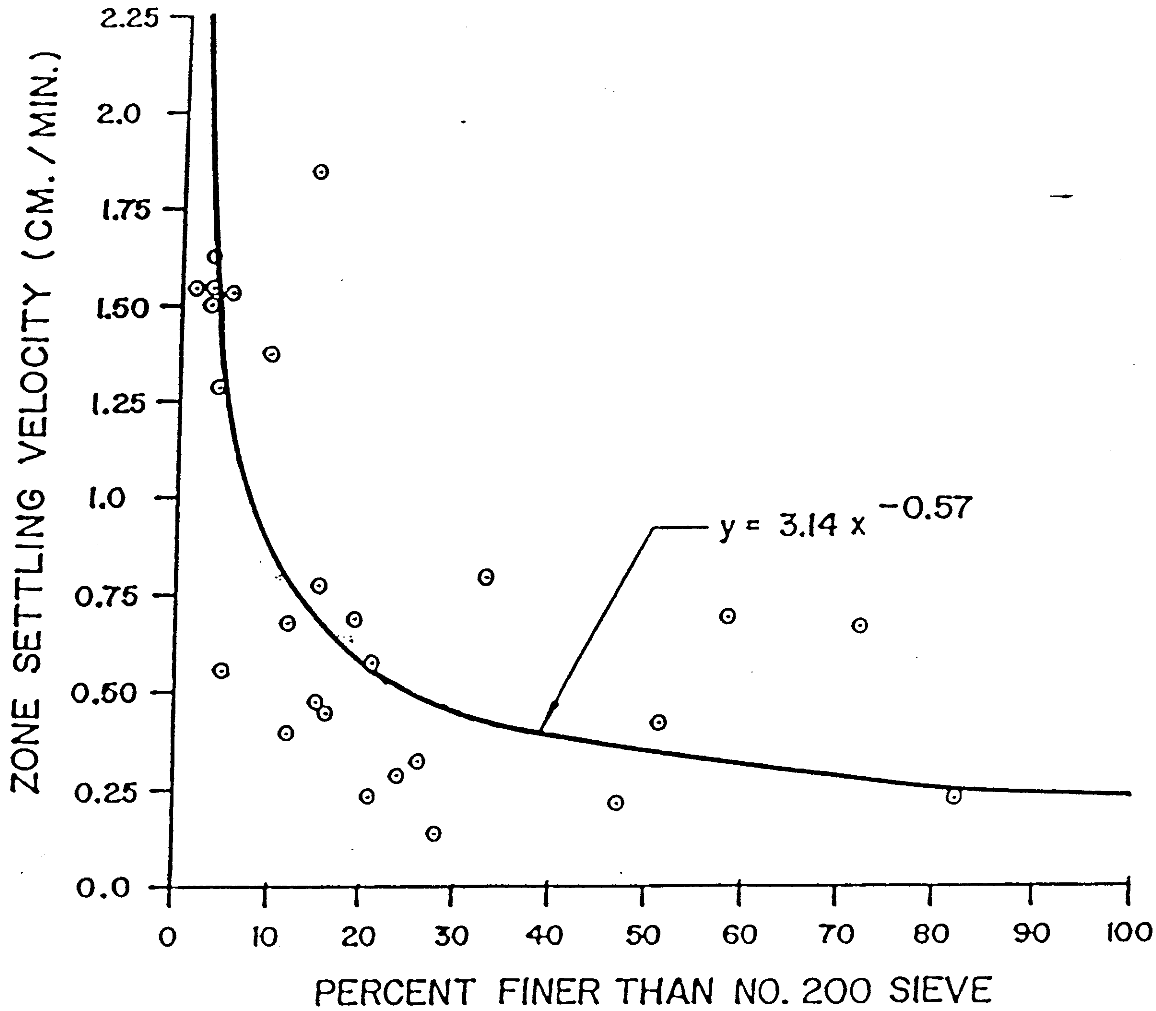

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Figure 2-3
Zone Settling Velocity of
Intracoastal Waterway Channel Sediments
(Taylor and McFetridge, 1989b)

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depth of 2.0 feet is 3.34 hours, based on the zone settling velocity derived above. However, research by the U.S. Army Waterways Experiment Station (WES) under the Dredged Material Research Program (DMRP) (Shields et al., 1987) indicates that the predicted settling time of the dredged material should be multiplied by a correction factor of 2.25 to account for field conditions. This yields a adjusted required settling time of 7.52 hours. Thus, the BV-2C containment basin provides a retention time which greatly exceeds the adjusted settling time required to maintain adequate sedimentation and effluent quality.

Ponding depths should be maintained above the 2.0 foot minimum whenever possible. Indeed, field conditions may require that the ponding depth must be increased above the minimum if effluent turbidity standards cannot be met. The recommended operational ponding depth for Site BV-2C is 4.0 feet, with a maximum ponding depth limited to 5.0 feet. The use of a 4.0 feet operational ponding depth results in a basin retention time of 164.8 hours, thereby providing an additional margin of safety and a basin retention time adequate to maintain the required effluent quality. Care must be taken not to increase ponding depth above the minimum too quickly, a situation which may lead to dike saturation, piping, slumping, and other conditions of dike instability. Operational experience has demonstrated that if ponding depth is increased at a sufficiently slow rate, the permeability of the dike is reduced as fine sediments are filtered and trapped by percolation, thereby limiting dike saturation and instability. Restricting the initial ponding depth to 4.0 feet should minimize the occurrence of unstable dike conditions, while providing a sufficient safety factor to ensure efficient solids removal.

In addition to the recommendation of a ponding depth which exceeds that required for adequate basin performance, several additional considerations emphasize that the design of the BV-2C containment basin is conservative. DMRP research indicates that under field conditions the depth of withdrawal may be significantly less than that predicted by the WES Selective Withdrawal Model referenced above. Therefore, the use of the WES Selective Withdrawal Model provides a conservative containment area design. It should also be noted that a withdrawal depth of 2.0 feet is not expected to result in the resuspension of sediment because of the negative slope of the deposition layer from inlet to weir, which produces ponding depths at the weir greater than the minimum 2.0 foot average over the entire containment area. Moreover, providing the recommended operational ponding depth of 4.0 feet should further eliminate the possibility of resuspension, as well as doubling the retention time over that provided by a 2.0 foot ponding depth. Such measures should ensure that the turbidity of the effluent released from the BV-2C material management area complies with state water quality standards.

It should also be noted that the design dredge discharge of 6,430 cy/hr is based on a minimum distance from the dredge plant to the material management area. Increasing the distance over which the dredged material must be pumped results in increased line losses in the dredge pipe, thereby reducing output. This, in turn, produces an increase in the containment basin retention time. The maximum pumping distance for BV-2C to serve Reach I is 6.4 miles. Thus, actual dredging operations may lead to significant increases in basin retention time, and a further decrease in the turbidity of the effluent released from the site. However, because the design of the BV-2C containment basin is based on the maximum dredge plant output, and is therefore conservative, the site does not require reduced dredge output for compliance with state water quality standards.

2.3.4 Interior Earthworks

Secondary compartmentalization of the BV-2C containment basin is neither required nor is it desirable. Analysis of historical dredging records indicates that the projected frequency of dredging (at intervals of approximately five to ten years) does not warrant the use of parallel containment basins. Neither is the use of spur dikes to improve retention times appropriate for the site. The inappropriateness of such measures is derived from several considerations. One is that the increased retention times which may result from the use of spur dikes does not offset the concurrent loss of capacity within the containment basin. Another is that although they are intended to improve the efficiency of fine particle retention, spur dikes are often counter-productive because they restrict flow, leading to increased velocities and the possibility of sediment resuspension. For this particular site the increased irregularity of the containment area geometry would result in more dead zones, a reduced effective retention area, and less uniform deposition. Moreover, a preliminary analysis of the efficiency of the BV-2C containment basin indicates that retention times adequate to allow precipitation of the finest category of sediment likely to be encountered are achievable without recourse to the use of spur dikes.

2.3.5 Ramps

Ramps to provide heavy equipment access to the basin interior have been integrated into the design of the containment dikes (Figure 2-2). This was done to provide the capability of efficiently removing the dewatered dredged material as containment capacity needs dictate. Thus, the material management facility is designed to function more as a material processing and rehandling station than as a permanent storage facility. In this manner, the useful service life of the site may be extended indefinitely.

The ramps themselves obliquely traverse the containment dike, maintaining the same 1V:3H side slope as the dike. The recommended ascending/descending grade is 5 percent, with a road surface width of 12 feet. The ramps are positioned to facilitate the entry and exit of heavy equipment via a connection to Dixie Way near the southwestern corner of the site (Figure 2-1). In addition to providing for material removal, the ramps also allow easy entry for equipment to be utilized in the dewatering process. This is discussed in Section 3.0.

2.3.6 Perimeter Ditches

The migration of saltwater from the interior of the containment basin into the on-site shallow aquifer is not expected to be a significant problem because of the relatively infrequent periods of short duration in which saltwater will be present on-site, and because of additional facility design precautions described here. As discussed elsewhere in this report, ponded saltwater will be present within the containment area only during actual dredging operations and for a short period immediately following dredging to allow the clarified effluent to be released back to the Indian River. Such periods are expected to last 4 to 8 weeks, at a frequency of once every five to ten years. Notwithstanding this, as an added precaution to ensure that the horizontal migration of saltwater on-site is contained at or near the diked area, a system of ditches will be constructed at a 20 foot setback from the outer toe of the dikes. These ditches will surround the outer perimeter of the containment basin, thereby inhibiting the horizontal migration of water. The ditches will also serve to control the flow of storm runoff from portions of the site outside of the containment basin. In addition, as discussed in Section 3.5, shallow wells placed within the site buffer area will be monitored prior to, during, and following dredging operations to detect any potential saltwater migration from the dike area. Should elevated chloride levels be observed in the well samples during dredging operations, pumping will be ceased immediately and the ponding depth within the basin will be decreased.

To effectively intercept saltwater migration during the initial dredging operation, the ditch invert must be at or below the adjacent excavated interior grade of the containment basin. Therefore, the elevation of the ditch bottom will coincide with that of the basin interior. The ditches will have a 1V:3H sideslope and an average bottom width of 3 feet. Preliminary analysis indicates that a minimum depth of

2.0 feet will provide adequate conveyance for the 25 year storm runoff from the contributing drainage area, consisting of the exterior face of the containment dike, the perimeter road, and limited portions of the buffer area adjacent to the ditches. Control and conveyance of stormwater runoff from within the containment basin is discussed in Section 4.2.1.

2.3.7 Dike Erosion and Vegetation

The stability of the containment dike must also be ensured against erosion from rainfall runoff, and wind. This will be accomplished by vegetating the dike slopes and crest immediately following dike construction (Figure 2-2). Native grasses will be used (including, but not limited to Paspalum vaginatum) which quickly form soil binding mats while not rooting so deeply so as to structurally weaken the dike. Planting will be on maximum 18 inch centers using nursery stock (slips) to ensure rapid coverage. As an alternative, seeding may be preferred to the use of slips if the scheduling of construction and maintenance operations provides the additional time required for the vegetation to become established. An additional benefit of vegetating the dikes in this manner is the reduction of the visual impact of the containment basin thereby improving the aesthetic character of the site.

2.3.8 Site Security

Security should be provided appropriate to the commitment of public funds that this project represents. Permanent security fencing will be erected along the site property boundary during the initial phase of construction to control public access to the site interior. Access to the site will be controlled by locked gates. Keys to these gates will be held by FIND and distributed on an as needed basis to agents of the COE, dredging contractors, and other authorized parties. It is anticipated that citrus production will continue in portions of the buffer area by local citrus growers under an agreement with FIND. If so, keys to the gates will also be provided to the growers to be used at their discretion. If deemed necessary to maintain adequate site security, an inner fence surrounding the containment area will be erected with access controlled solely by FIND.

In addition, on-site operators should be present at all times during active dredging operations, and decanting operations following a dredging event, or at any time when significant ponded water remains within the containment area. This is to ensure the proper operation, adjustment, and maintenance of the weirs, as well as to prevent the premature release of effluent through unauthorized weir operation. Active on-site operations are discussed in more detail in Section 3.0.